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THE BRITISH ASSOCIATION MEETING, BRADFORD, 1900.

FROM the meteorologist's point of view, though from his alone, the meeting at Bradford was by no means brilliant. Perhaps the fact that the International Meteorological Congress was meeting during the same week in Paris, may account for the small number of students of atmospheric phenomena who were present; but of the few who did attend, the Committee of Section A did not include one. While this may have been an oversight on the present occasion, there have been signs, for some years back, that the meeting for meteorological papers held by Section A on the Monday, is viewed with little interest, either by the sectional officers or by the members of the Association. The reports of several committees were presented, that relating to Ben Nevis contained the gratifying news that funds have been received to keep our only high level station going for a few years longer. The Committee for recording the intensity of solar radiation made a long report, dealing with experiments on the copper-cube actinometer, and other instruments, by which the value of the radiation may be measured in absolute units, but a final result has not yet been obtained.

Mr. A. Lawrence Rotch, of Blue Hill Observatory, Massachusetts, sent a paper on the use of kites for raising instruments by which to observe the meteorological conditions of the upper atmosphere.

Mr. A. S. Davis showed a novel type of barometer, which has the advantage of being only ten inches in length, but has practical disadvantages of such a kind as to render it little better than a scientific curiosity.

Mr. J. W. Thomas described the effect of wind on the ventilation of houses, with particular reference to the smoking of chimneys when there is a high wind blowing and insufficient means of admitting air into the room to feed the draught of the fire.

The most important paper read was undoubtedly that by Captain Campbell Hepworth, on the weather of the North Atlantic Ocean in the winter of 1898–99. The Meteorological Office has investigated the remarkably stormy weather experienced during that winter,

and, from the numerous logs of ships it has received, has prepared charts showing the weather conditions at local noon for the whole basin of the North Atlantic, for sixty consecutive days. While these are not synchronous charts by any means, they are of extreme interest, and it is hoped they will soon be published. The stormy weather on the Atlantic was accompanied by a remarkably cold winter in America, February, 1899, being characterised by a frost which was unapproached in duration and severity since the U.S. Weather Bureau was founded. A minimum of —61° F. was recorded at Fort Logan, Montana, and masses of river ice were carried out by the Mississippi into the semi-tropical Gulf of Mexico. At the same time Europe was enjoying a winter of unparalleled mildness, the thermometer at Liége rising to a maximum of 70°·5 F. This was on February 10th, the very day of the intense cold at Fort Logan, and the extraordinary range of 131·5° F. was found between two places practically in the same latitude.

Mr. John Hopkinson read a paper on the rainfall of the northern counties of England, the following table summarising his results. The stations were selected on account of their records being complete for the ten years under consideration, but apparently without regard to their distribution over the area of the county.

Mean Rainfall in the Northern Counties of England, 1881-90, *according to Mr. John Hopkinson.*

	Northumberland, 11 stations.	Durham, 7 stations.	Cumberland, 6 stations.	Westmoreland, 8 stations.	Lancashire, 11 stations.	Yorkshire, 26 stations.	Cheshire, 7 stations.	Derbyshire, 4 stations.	Nottinghamshire, 3 stations.	Lincolnshire, 11 stations.	Mean, 94 stations.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
January ...	2 23	2·02	5 68	5·69	3·35	2·88	2·35	3·61	1·94	1·72	3·04
February	1·73	1·47	4·62	4 47	2·30	2·12	1·77	2·63	1·58	1·60	2·32
March ...	2·73	2·55	4·49	4·53	2·89	2·70	2·11	3·16	1·87	1·68	2·82
April ...	1·98	2·01	3·05	2·86	2·05	2·23	1·69	2·48	1·64	1·65	2 15
May ...	2·15	2·04	3·77	3·54	2·56	2·38	2·22	2·84	2·19	2 03	2 50
June ...	1·92	1·81	3·10	2·89	2 69	2 10	2·57	2·74	1·80	1·78	2·27
July ...	3·38	3·31	5·58	5·31	3·98	3·33	3 31	3·56	2·47	2·44	3·60
August ...	3·14	2·64	4 52	4·20	3·64	3 05	3·05	3·43	2·28	2·30	3·19
September	2·86	2·30	5·58	4·90	3·67	2·70	3·02	5·25	1 94	2·18	3·14
October ...	3·18	3·04	5·33	5 36	3·81	3·72	3·32	4·47	2·68	2·81	3·72
November	3·15	2·68	6·72	6·67	4·01	3·29	3·30	4·49	2·16	2 27	3·72
December	2 58	2·27	5·48	5·46	3·38	2·85	2·63	3·57	1·89	1·84	3·09
Year ...	31·03	28·14	57·92	55·88	38·33	33·35	31·34	*40·23	24·44	24·30	35·56

Mr. Hopkinson took occasion to refer in terms of high appreciation to the work of the late Mr. G. J. Symons, and to the efficiency of

* This column adds to 42·23.—Ed. *M.M.*

the Rainfall Organisation which he founded. Dr. H. R. Mill pointed out that the results of the estimate of mean rainfall would be more satisfactory if the stations were selected to represent proportionally the regions of different intensity of rainfall in each county, but he cordially endorsed Mr. Hopkinson's eulogium of Mr. Symons, whose regular attendance at the British Association Meetings made the present gathering seem poor and sad.

Geology has invaded the territory of many sister sciences, but we are hardly prepared for the discovery of fossil cyclones. This, however, is very like what Mr. Harmer announces in his paper to Section C., entitled, "The influence of winds upon climate during past epochs; a meteorological explanation of some geological problems." There is no doubt that if the arrangement of land and sea at any epoch in the past can be ascertained, it may be possible to deduce the probable general distribution of atmospheric pressure and the resulting winds, the attempt, at any rate, is full of interest.

An important meteorological paper was read to Section E (Geography) by Mr. E. G. Ravenstein, who dealt with the geographical distribution of relative humidity, and exhibited a series of maps he had compiled to show how that datum varies in different parts of the world.

Combining humidity and temperature, the author suggested mapping out the earth according to sixteen *hygrothermal types*, as follows:—

1. Hot (temperature 73° and over) and very damp (humidity 81 per cent. or more): Batavia, Camaroons, Mombasa.
2. Hot and moderately damp (66–80 per cent.): Havana, Calcutta.
3. Hot and dry (51–65 per cent.): Bagdad, Lahore, Khartum.
4. Hot and very dry (50 per cent. or less): Disa, Wadi Halfa, Kuka.
5. Warm (temperature 58° to 72°) and very damp: Walvisch Bay, Arica.
6. Warm and moderately damp: Lisbon, Rome, Damascus, Tokio, New Orleans.
7. Warm and dry: Cairo, Algiers, Kimberley.
8. Warm and very dry: Mexico, Teheran.
9. Cool (temperature 33° to 57°) and very damp: Greenwich, Cochabambo.
10. Cool and moderately damp: Vienna, Melbourne, Toronto, Chicago.
11. Cool and dry: Tashkent, Simla, Cheyenne.
12. Cool and very dry: Yarkand, Denver.
13. Cold (temperature 32° or less) and very damp: Ben Nevis, Sagastyr, Godthaab.
14. Cold and moderately damp: Tomsk, Pike's Peak, Polaris House.
15. Cold and dry:
16. Cold and very dry: Pamir.

The actual mean temperature of the earth amounted, according to his computation, to 57° F., and this isotherm, which separated types 8 and 9, also divided De Candolle's "Mikrothermes" from the plants requiring a greater amount of warmth.

The report of a Committee on the Climate of Tropical Africa, was also read in Section E. This Committee was re-appointed in order to draw up a final report of its ten years' work.

STUDIES OF CYCLONIC AND ANTICYCLONIC PHENOMENA WITH KITES.

(*Continued from p.* 120.)

This continuity of record, the steady ascent, and the possibility of keeping the instruments suspended for considerable periods together, so as to record not merely changes with elevation, but changes at the same height at successive intervals (often as much as 12 hours) of time, give to these observations at Blue Hill a value greatly beyond anything hitherto accomplished by balloons, free or captive. The small free balloons (les ballons sondes) first sent up by MM. Hermité and Besançon, and the recent simultaneous international flights of similar balloons in different parts of the Continent, have no doubt extended our knowledge of the general conditions of the free air up to heights that will probably never be attained by man, and possibly never reached by kites. At the same time, such flights can never be anything more than spasmodic and sporadic; and since captive balloons are virtually useless, except in the rare case of calm above and below, and mountain stations do not give us the true conditions in the free atmosphere, kites are evidently, as originally stated by Mr. Archibald, in 1883, the best means hitherto available for conducting researches into the meteorology of the upper air.

Before alluding to the results attained in the recent flights at Blue Hill, it is important to observe that considerable care appears to have been taken to ensure reliable records. The sensitiveness of the thermometer, for example, is very essential where ascent and descent are concerned, and by practical checks and comparison with what ought to occur from theory, the instrument is shown to reach a most desirable standard in this respect. Great care is also taken to insulate it from undue direct exposure. The hair-hygrometer, which is the only feasible form for kite suspension, is admitted to be not so trustworthy. It is uncertain at extreme points, and more sluggish than the thermometer. In fact, a thoroughly reliable and conveniently portable recording hygrometer is still a desideratum. By empirical corrections, the final results in the present case are stated to be accurate within about 10 per cent. of the true amounts, and as the hygrometry in these researches is distinctly subordinate in importance to the thermometry and barometry, this approximation

appears to be satisfactory. The flights dealt with in Mr. Clayton's Bulletin occur in groups, thus :—

1899.	Feb. 23 to 28.	Sept. 4 to 6.
	May 24 to 27.	Oct. 31 to Nov. 2.

representing both typical conditions of the season, as well as of incidental and transient cyclones and anticyclones.

The maximum heights attained in each of these groups range nearly up to or over 3,000 metres above sea-level, while the highest on February 28th, was as much as 3,792 metres (12,441 feet).* The times of flight from ascent to descent varied from 8 to 12 hours, and in some cases included entire nights.

In the discussion the results are analysed and differentiated, so to speak, for height, time, rate of increase or decrease of height, progress of cyclonic and anti-cyclonic condition, and are plotted so as to shew the changes at constant height with variable time, and where both height and time are taken as variables.

Taking temperature first: it has been found from about 250 kite flights at Blue Hill that in no case does the decrease of temperature appreciably exceed the adiabatic rate for dry air (about 1°·6 F. for 300 feet), except near the ground, and that in general it approximates to the 1° F. in 300 feet, or nearly 1° C. in 100 metres, which is found, by balloon ascents and mountain observations, to be the average observed temperature difference with the height.

This average, however, by no means holds continuously from the ground upwards, but is liable to interruptions, in which the law of decrease is suddenly inverted, so that, as Mr. Clayton says—"Within a short distance vertically there is a sharp rise of temperature, and above this the temperature decreases with the elevation as before." Sometimes, as on February 18th, May 27th, &c., two or more of these sudden rises of temperature form breaks in the fall of temperature, with increase of height, so that the curves may be compared to inverted stair steps." These breaks are found in anticyclones as well as in cyclones. They occur with cloudless skies, as well as when the sky is covered with dense clouds. They are found at night as well as by day, and in fact are more marked at the former time. Balloon observers have noticed these inverted gradients, but since they generally occurred about or above the cloud levels, they erroneously attributed them to the insolation on the upper cloud surface. It is obvious, however, that such an explanation entirely fails to account for their prevalence at night.

These strata, of which there are sometimes two or three between the ground and the altitude of 3000 metres, are also bounded by regions of sharp contrasts in a vertical direction of temperature, humidity, and sometimes of wind-direction. These boundaries are, moreover, loci of maximum wind velocity and cloud formation.

There seems thus a marvellous analogy between such air strata which are potentially warmer than the air below them, and super-

* On July 19th, 1900, 15,800 ft. was reached with 4¾ miles of wire.

ficial ocean currents, such as the Gulf Stream, Kuro Siwo, &c. Their temporal existence had often been surmised, but such an objective reality and constancy as that shewn by the Blue Hill observations had certainly not been proved heretofore. That variations in the thickness, altitude, temperature, humidity, and velocity of such currents must have an important bearing upon the incidence and prevalence of meteorological conditions is obvious, and if this were the sole outcome of the kite observations at Blue Hill, it would of itself form a valid *raison d'être* for continuing and extending such observations. This, however, is only one of the plums in the cake.

When the general average decrease of temperature with the altitude is compared in cases where cyclonic and anticyclonic conditions were prevalent, it is found that up to all elevations the decrease is greater in cyclones than in anticyclones, agreeing thus with the results found by Dr. Hann, M. Teisserenc de Bort, and others.

The comparison also shews an increasing rate with increase of height, a conclusion entirely in agreement with that derived by Drs. Assman and Berson, from the momentary records of the upper atmosphere with "ballons sondes."

Both the relative and absolute humidities are found to diminish much more rapidly with the height in an anticyclone than in a cyclone. In fact, when the lines of equal condition are traced all through cyclonic and anticyclonic periods, it is found that "above anticyclones and areas of low temperature, the vapour tension approaches zero at all times of the year."

The wind velocity in every case increases with the height, but the increase is much less in the anticyclone than in the cyclone. The table in which this is shewn is so brief, and withal instructive, that we reproduce it here, converted into English measure.

Increase of wind velocity, with height (in miles per hour).

	feet.	feet.	feet.
Height in feet	0—3280	0—6560	0—9840.
Anticyclones.....	4	8	—
Cyclones	17	22	30

The gap at the higher levels above anticyclones simply indicates the frequent absence of sufficient wind above anticyclones to lift the kites continuously to such an altitude.

Another conclusion of considerable importance to which these observations at Blue Hill lead, is that "the curves shewing the changes of temperature at different heights indicate that the temperature changes are alike at all heights, up to at least 3,000 meters (9,843 feet), in other words, the warm and cool periods, occur aloft at the same time that they occur near the ground." Thus what are popularly termed warm and cold waves are not confined to a limited vertical section of the atmosphere, but are connected with grand movements in which the entire vertical section

of the atmosphere is concerned. This conclusion is shewn to accord with observations on Pike's Peak and Fusiyama, while Teisserenc de Bort's observations with "ballons sondes" carry on the same law to a height of 11 kilometers (36,000 feet). The full meaning of this fact awaits solution, but it certainly negatively disfavours the vertical instability theory of cyclone generation.

Another fact, of perhaps even more prime importance in relation to atmospheric physics, is "that the maximum air temperature at all heights nearly coincides with, but slightly precedes, the minimum of air pressure at sea-level. The minimum of air temperature at the different heights apparently occurs when the air-pressure at sea-level is above normal, but usually some distance in advance of the maximum of air-pressure at sea-level." In other words, the mass of the air in the normal cyclone of the weather map* is warmer than that of the mass of the air in the anticyclone. This would appear to be rather in opposition to the views promulgated by Dr. Hann, some few years back; but the discrepancy will probably be found in the circumstance that Dr. Hann relied upon mountain observations, which, owing to obvious physical causes, do not give the true values for the free atmosphere at the same level, especially in the element of temperature.

The diagrams which shew the changes in height of the lines of equal condition are, perhaps, the most interesting and instructive of any. They shew, for example, that "the belts of inverted gradient [which represent the air-currents already alluded to] reached their greatest distance from the ground about the time of minimum temperature, and were nearest the ground about the time of maximum temperature." This, taken with the facts mentioned in the preceding paragraph, shews a point which seems to have escaped even the keen eye of Mr. Clayton, viz.: that, approximately, these currents recede from or approach to the earth's surface with the rise and fall of the sectional isobars, indicating the passage of anticyclonic and cyclonic conditions. The bearing of this on weather changes is manifest.

Another very important deduction, though from limited data, is "that the oscillations in the height of the isotherms caused by the diurnal period in temperature occurred only in the stratum below the first belt of inverted gradients." In other words, the normal direct effect of the diurnal heating and cooling on the temperature of the free atmosphere is probably confined entirely within the first 2,000 feet or so above the surface. This agrees with Prof. Hill's observations at Allahabad, and Dr. Hergesell's at Strasbourg.

The same method of comparing the lines of equal wind velocity, or as they may be termed, isovels, shews a remarkable upward extension of the lines of low wind-velocity over the anticyclone, and a downward dip of the lines of high wind-velocity on each side of the line of minimum pressure, with an area of lighter winds between.

* This is necessary to distinguish the warm-centred surface cyclone from the theoretical upper air cold-centred cyclone.

Mr. Clayton concludes this exceedingly interesting monograph by first noticing the general results of observations made on mountain peaks and balloons in other parts of the world; and, to eliminate the effects of insolation and radiation on mountains, recommends that the temperatures at summit and base be taken near 8 p.m., at which epoch both tend to be at their minimum, while the temperature is about the normal for the 24 hours.

He then discusses in the light of the deductions from the data furnished by the Blue Hill kites, the various theories of cyclone and anticyclone generation. This is a bold plunge to take with such comparatively sparse observations; but it must be admitted that Mr. Clayton makes out a very good *primâ facie* case for his conclusions.

After noticing in turn—

(1) the theory of vertical instability;
(2) the convection theory, which may, with some degree of propriety, be termed the theory of horizontal instability;
(3) the condensation theory;
(4) the driven eddy theory;

as theories of cyclone generation, he decides in favour of (2) the convection theory, as "the theory with which the observations in the free air with kites best agrees." At the same time he very properly remarks—"Probably no meteorologist believes that any one of these causes acts entirely alone in cyclone formation. But opinion differs as to which is the principal cause, and to what extent each of the other causes is a subsidiary cause. All the theories agree in ascribing the primary cause to differences of temperature."

If Mr. Clayton will admit that some of the other causes still contribute in a subsidiary degree to the result, little fault can be found with his conclusion that the horizontal differences of temperature are, perhaps, the major cause; and since the anticyclone is the necessary complement of the cyclone, the same conclusion applies to its generation, coupled with a certain degree of complexity, due to the fact that areas of high pressure at the surface may be due to the overlapping of pericyclones surrounding both the cold-centred cyclones of the upper air and the warm-centred cyclones of the middle and lower strata.

In any case, it is plain that the kite observations are yielding data of the utmost importance to the advance of both theoretical and practical meteorology; and are enabling us at last to learn what is really happening in that third dimension of space, which is inaccessible and whose conditions are for the most part either averaged into a single quantity or unrepresented in the charts constructed from observations ordinarily available to dwellers on the surface of our globe.

THE WEATHER OF AUGUST.—COLD PERIODS.

To the Editor of the Meteorological Magazine.

SIR,—July this year, was, we know, very hot; and August was cool. A hot July apparently tends to be followed by a hot August; that is, it is so followed about twice as often as by a cool one. But there is a curious fact *per contra*; which may be correlated with the general contrast in temperature of summers in the earlier and the later half of decades, to which I have recently referred. It is, that of eighteen years ending 0, 1 and 2 (*i.e.*, in the last six decades), only one (1852) had a summer in which both July and August were *hot*. On the other hand, of eighteen years ending 5, 6 and 7, only two (1845 and 1866) had summers in which both July and August were *cool*. Thus, it was probable, I think, that last August would be cool.

The Jubilee summer (1887), which Londoners remember as very hot, does not come out prominently in Mr. Parbury's table (p. 119) for the Godalming district, with only July hot; at Greenwich all three months were hot. This table brings out very well one aspect of the fact of a recent cold period followed by a warm one.

If we consider years in tens (1841 to 1850, 1842 to 1851, and so on), averaging, *e.g.*, the mean temperature of December to March, in each 10-year group, we perceive a very prominent wave crest, or centre, of cold, about 1890, and another, less conspicuous, about 1856; while a centre of warmth, or mildness, lies about midway between those dates. Now, from 1856 to 1890 is 34 years, which agrees very well with Brückner's cycle (average 35 years). But then 1856 falls in one of Brückner's *warm* periods (1851–70); as also, presumably, 1890, since a cold period ends in 1885. And our warm centre, about 1873, falls in the *cold* period 1870–85. Are we, then, to suppose that London is in one of his "exceptional regions" (*Ausnahme gebiete*), as regards temperature?

Curiously, however, if we average our rainfall in 10 year groups, we find conspicuous centres of *dryness* about 1859, and, probably, 1894; and a wet centre about 1876; and these fall in Brückner's normal dry and wet periods respectively. They are associated, too, with the appropriate barometric conditions. Thus rainfall and pressure are apparently normal, while temperature is anomalous.

We find this kind of sequence: cold centre about 1856, followed by dry centre 1859 (3 years later); warm centre 1873, followed by wet centre 1876 (3 years later); cold centre 1890, followed by dry centre (say) 1894 (4 years later).

The rainfall in these 10-year groups, about the dry and wet centres, may be indicated:—

Ten years about		1859,	rainfall	224·1	inches.
,,	,,	1876	,,	268·2	,,
,,	,,	1894	,,	221·7	,,

It may be mentioned that Brückner's cold and wet periods are

nearly synchronous, likewise his warm and dry periods; but the wet sometimes last a little beyond the cold.

Perhaps some of your readers who may have studied the subject would give us their views on the above anomaly. I may possibly be under some misapprehension as to Brückner's ideas, and should be glad, in that case, to be corrected.—Yours faithfully,

A. B. M.

DOUBLE LUNAR RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—Yesterday evening I was fortunate enough to see a most beautiful example of a double lunar rainbow; the primary bow was very bright, quite complete, and showed the prismatic colours most clearly; the secondary bow was faint, but also almost complete, though the colour was barely discernible; the appearance lasted from 9.10 to 9.30 p.m.

Both the rainbows were apparently projected on a background of absolutely clear sky, so that at 9.20 I could clearly see the third magnitude stars θ and Ψ, Ursæ Majoris, shining *through* the primary bow; this apparent absence of cloud is not unfrequent with a solar rainbow, but I have never seen it before in the case of a lunar rainbow.

The softness and brilliancy of the whole phenomenon was most remarkable.—Yours truly,

CHARLES L. BROOK.

Harewood Lodge, Meltham, October 5th, 1900

ANOTHER USE FOR THE KITE.

A few years since we had occasion to enumerate the various uses to which ingenious men have applied the kite. Among these was its application to the saving of life by carrying a line from a shipwrecked vessel over the breakers to the wreckers on the shore beyond. We now learn that two young men in Chicago have given an exhibition showing how those within a besieged town or other inaccessible place can use the kite line to carry a telephone, with its separate telephone wire, through the air, and let it drop from the kite upon a distant place while the kite still remains in the air. By using a very large box kite, and attaching to the kite line a little way below the kite a pulley through which runs the telephone wire, the telephone may be dropped from the pulley, while the insulated wire keeps up the connection with the man at the kite reel. Of course, at the present time, when kites have rarely been sent out with more than two miles of wire, which corresponds to a horizontal distance of much less than two miles, this method does not promise to put us into communication with persons at a great distance, but it may, of course, be very useful for short distances.—*Monthly Weather Review.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1900.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	58·6	12	23·4	18	46·9	33·7	33·6	79	97·1	20·2	·79	7	6·7
Malta	71·7	28	41·8	12	62·4	49·8	45·9	73	133·7	36·1	1·04	7	4·0
Cape of Good Hope	87·3	3	45·4	21	75·7	58·4	56·4	77	...		·65	5	3·7
Mauritius	85·6	16	67·2	3	83·6	73·7	71·0	81	156·7	61·3	9·15	23	5·3
Calcutta	101·7	20	60·5	1	94·5	71·5	67·7	62	153·9	54·5	·12	4	1·8
Bombay	91·7	13	69·8	5	85·7	73·3	70·1	74	133·5	61·6	·00	0	1·5
Ceylon, Colombo	95·5	27	73·0	12	94·0	75·7	73·0	73	153·0	68·0	3·71	7	1·2
Melbourne	89·8	13	45·6	29	72·6	53·4	51·1	67	148·8	39·5	3·95	11	5·6
Adelaide	103·2	13	47·9	25	76·9	57·6	51·6	57	153·7	41·2	2·76	11	5·2
Sydney	88·9	18	57·5	22	76·5	64·6	57·3	72	149·0	49·2	6·02	14	...
Wellington	75·0	2	46·0	10	68·7	54·3	50·4	68	128·0	39·0	3·56	8	4·2
Auckland	78·5	9	54·5	18*a*	72·9	59·5	55·4	68	139·0	51·0	1·52	10	4·5
Jamaica, Halfway Tree	89·0	20	63·0	14	84·6	68·2	65·4	72	...	...	·28	2	3·1
Trinidad	...	...	...	...	...	...		...	...	...	...	...	...
Grenada	86·4	16	70·2	1	83·3	73·0	68·9	70	160·0	..	1·94	14	2·7
Toronto	43·8	6	−3·0	5	32·0	15·4	19·0	76	57·9	−6·0	3·45	12	5·1
New Brunswick, Fredericton	50·3	20	−20·0	6	36·1	12·0	13·0	62	...	...	3·67	7	4·9
Manitoba, Winnipeg	47·2	31	−24·5	4	23·6	1·0	...	...	...	...	·68	8	5·6
Victoria, British Colombia,	67·0	31	34·8	5	53·6	43·1	...	...	..	...	3·63	15	6·4

a—and 21.

REMARKS.

MALTA.—Adopted mean temp. 55°·0, or 0°·9 below average. Mean hourly velocity of wind 10·8 miles, or 0·1 below average. Mean temp. of sea 61°·4. TSS on 6th and 18th; H on 5th, 7th and 18th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·3, of dew point 1°·0, and rainfall ·86 in., above their respective averages. Mean hourly velocity of wind 8·7 miles, or 2·3 below average; extremes, 22·9 on 20th and 1·6 on 12th; prevailing direction, S.E. by E. and E.S.E. L and T on 6th to 8th and 23rd to 25th; L on 9th, and T on 14th and 22nd. T. F. CLAXTON.

CEYLON, COLOMBO.—Mean temp. of air 84°·3, or 2°·4 above, of dew point 0°·1 above, and rainfall 1·07 in. below, their respective averages. Mean hourly velocity of wind 6 miles; prevailing direction, S.W. TSS on 27th and 30th; L on 8 days. H. O. BARNARD.

Adelaide.—Mean temp. of air 3°·3 below the average, and the lowest, with one exception, in 43 years. R 1·74 in. above the average. A splendid opening for the season this month; good rains falling all over the settled areas and extending well into the centre of the Continent. C. TODD, F.R.S.

Sydney.—Temp. 1°·3 above, humidity 3·8 below, and rainfall ·80 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Fine in the early part of the month; heavy R from the South between the 23rd and 26th. Prevailing winds N.W., frequently strong. Temp. 4°·5 above, and rainfall ·03 in. above, their respective averages. R. B. GORE.

Auckland.—With the exception of some slight showers, fine and dry throughout the month. Mean temp. slightly above, and rainfall nearly one inch below, the average. The fifth consecutive month with rainfall much less than the normal. T. F. CHEESEMAN.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1900.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	76·4	21	25·1	2	58·6	39·5	...	...	113·2	18·3	·98	15	5·2
Malta	75·9	29	45·4	3	65·6	52·4	51·2	78	139·5	42·5	2·18	9	2·6
Cape of Good Hope	88·9	3	48·4	29	73·9	58·1	59·1	82	...	...	1·45	8	5·1
Mauritius	83·5	6	66·3	13	81·3	72·0	69·6	81	146·2	59·3	3·16	15	6·3
Calcutta	103·6	2	69·0	10	96·3	76·4	72·7	66	158·1	68·1	2·75	5	3·9
Bombay	90·9	30	74·6	4	88·2	77·5	74·3	76	134·9	67·3	·00	0	1·9
Ceylon, Colombo	93·7	4*a*	73·0	24	90·4	76·2	75·9	83	152·4	71·0	9·73	21	5·4
Melbourne	74·0	8	39·6	16	62·5	50·1	49·4	83	134·2	36·0	4·97	19	7·7
Adelaide	75·8	22	43·9	15	67·3	53·4	50·6	71	136·3	37·0	3·70	18	7·3
Sydney	77·0	10	47·7	16	69·2	56·6	53·5	78	129·4	41·0	5·40	13	5·5
Wellington	70·0	14*b*	42·0	27*c*	63·4	53·1	50·3	75	117·0	33·0	5·53	18	5·1
Auckland	76·5	2	47·0	29	70·3	59·8	54·9	69	132·0	43·0	1·94	16	5·5
Jamaica, Halfway Tree	89·0	19	64·0	7	85·4	69·5	68·1	75	...	...	2·38	5	2·8
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	87·0	2, 7	70·0	25	84·4	74·6	70·4	73	154·2	...	2·38	14	3·0
Toronto	70·7	23	21·3	9	54·5	36·6	35·3	67	91·5	18·0	1·83	11	5·2
New Brunswick, Fredericton	76·1	21	19·2	5	51·4	29·4	24·8	56	...	...	2·87	10	6·0
Manitoba, Winnipeg	79·2	23	16·0	16	64·2	31·6	...	...	...	...	·30	5	3·4
Victoria, British Columbia	75·3	29	35·2	8	58·0	43·6		...	...	...	·87	9	5·5

a—8, 17. *b*—and 18. *c*—and 29.

REMARKS.

MALTA.—Adopted mean temp. 58°·1, or 1°·5 below average. Mean hourly velocity of wind 10·6 miles, or 1·2 below average. Mean temp. of sea 62°·2. TSS on 5 days; L on 1st and 20th; H on 3 days. J. F. DOBSON.

Mauritius.—Mean temp. of air equal to, of dew point 1°·2 above, and rainfall 2·20 in. below, their respective averages. Mean hourly velocity of wind 10·1 miles, or 0·5 mile below the average; extremes, 25·8 on 18th and 2·1 on 13th; prevailing direction, E.S.E. L and T on 6 days. T. F. CLAXTON.

CEYLON, COLOMBO.—Mean temp. of air 82°·6, or 0°·1 above, of dew point 1°·6 above, and rainfall 1·58 in. below, their respective averages. Mean hourly velocity of wind 7·1 miles; prevailing direction S.W. TSS occurred on 11 days; L alone was seen on 5 days. H. O. BARNARD.

Adelaide.—The coldest April in 43 years: mean temp. 3°·8 below the average. The previous lowest max. was 81°·2 in 1876. Also very cloudy—the most cloudy April in 32 years. Rain double the average. Good general agricultural rains all over Colony. C. TODD, F.R.S.

Sydney.—Temperature 1°·7 below, humidity 0°·1 above, and rainfall ·12 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Heavy rains during the month. Prevailing winds N.W., frequently strong. A few fine, pleasant days. Hail on 27th; fog on 13th and 14th. Temp. 1°·2 above, and rainfall 2·01 in. above, their respective averages. R. B. GORE.

Auckland.—An unusually dry April, the rainfall being 1·25 in. under the average of 30 years. Mean temp. quite 3° above the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1900.

Div	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	·67	XI.	Builth, Abergwesyn Vic.	3·22
II.	Dorking, Abinger Hall .	...	,,	Rhayader, Nantgwillt...	1·99
,,	Birchington, Thor	·47	,,	Lake Vyrnwy	1·97
,,	Hailsham	1·35	,,	Corwen, Rhug	·95
,,	Ryde, Thornbrough	1·28	,,	Criccieth, Talarvor	1·19
,,	Emsworth, Redlands ...	·66	,,	I. of Anglesey, Lligwy..	1·82
,,	Alton, Ashdell	1·09	,,	I. of Man, Douglas	2·16
III.	Oxford, Magdalen Coll..	·36	XII.	Stoneykirk, Ardwell Ho.	2·61
,,	Banbury, Bloxham	·43	,,	New Galloway, Glenlee	3·75
,,	Northampton, Sedgebrook	·55	,,	Moniaive, Maxwelton Ho.	3·38
,,	Alconbury	·35	,,	Lilliesleaf, Riddell	1·77
,,	Wisbech, Bank House...	·51	XIII.	N. Esk Res. [Penicuick]	3·95
IV.	Southend	·82	XIV.	Glasgow, Queen's Park..	3·70
,,	Colchester, Lexden	·69	XV.	Inverary, Newtown	8·48
,,	Saffron Waldon, Newport	·66	,,	Ballachulish, Ardsheal...	8·82
,,	Rendlesham Hall	·77	,,	Islay	4·68
,,	Scole Rectory	...	XVI.	Dollar.....	4·91
,,	Swaffham	·67	,,	Balquhidder, Stronvar...	6·80
V.	Salisbury, Alderbury ...	·83	,,	Coupar Angus Station...	1·92
,,	Bishop's Cannings	·86	,,	Blair Atholl	2·90
,,	Blandford, Whatcombe .	1·39	XVII.	Keith H.R.S.....	2·23
,,	Ashburton, Holne Vic...	2·26	,,	Forres H.R.S.	1·85
,,	Okehampton, Oaklands.	1·73	XVIII.	Fearn, Lower Pitkerrie..	1·81
,,	Hartland Abbey	2·01	,,	S. Uist, Askernish	3·53
,,	Lynton, Glenthorne ...	1·81	,,	Invergarry.....	5·50
,,	Probus, Lamellyn	1·81	,,	Aviemore, Alvie Manse.	3·68
,,	Wellington, The Avenue	·64	,,	Loch Ness, Drumnadrochit	2·94
,,	North Cadbury Rectory	·46	XIX.	Invershin	1·84
VI.	Clifton, Pembroke Road	·80	,,	Durness.....	6·72
,,	Ross, The Graig	·40	,,	Watten H.R.S.....	2·48
,,	Wem, Clive Vicarage ...	·79	XX.	Dunmanway, Coolkelure	3·23
,,	Wolverhampton, Tettenhall	1·23	,,	Cork, Wellesley Terrace	·83
,,	Cheadle, The Heath Ho.	1·22	,,	Killarney, Woodlawn ..	2·25
,,	Coventry, Priory Row ..	·53	,,	Caher, Duneske	·72
VII.	Market Overton	·38	,,	Ballingarry, Hazelfort...	1·31
,,	Grantham, Stainby	·21	,,	Limerick, Kilcornan ...	1·05
,,	Horncastle, Bucknall ...	...	,,	Miltown Malbay	2·93
,,	Worksop, Hodsck Priory	1·28	XXI.	Gorey, Courtown House	·87
VIII.	Neston, Hinderton	·62	,,	Moynalty, Westland ...	1·78
,,	Southport, Hesketh Park	1·86	,,	Athlone, Twyford	2·03
,,	Chatburn, Middlewood.	2·26	,,	Mullingar, Belvedere ...	1·73
,,	Duddon Val., Seathwaite Vic.	7·29	XXII.	Woodlawn	2·38
IX.	Melmerby, Baldersby ...	·86	,,	Crossmolina, Enniscoe ..	2·81
,,	Scalby, Silverdale	·66	,,	Collooney, Markree Obs.	2·64
,,	Ingleby Greenhow Vic..	·82	XXIII.	Enniskillen, Model Sch.	...
,,	Middleton, Mickleton ...	·93	,,	Warrenpoint.....	1·37
X.	Haltwhistle, Unthank H.	2·15	,,	Seaforde..	1·56
,,	Bamburgh	·78	,,	Belfast, Springfield	2·56
,,	Keswick, The Bank	4·97	,,	Bushmills, Dundarave..	3·52
XI.	Llanfrechfa Grange	1·72	,,	Stewartstown	2·32
,,	Llandovery	2·57	,,	Killybegs	4·32
,,	Castle Malgwyn	1·77	,,	Horn Head	3·12
,,	Brecknock, The Barracks	...			

SEPTEMBER, 1900.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·79	— 1·72	·41	27	7	80·4	16	42·6	4	0	0
II.		Tenterden	·88	— 2·03	·54	27	6	80·0	16	42·0	4*d*	0	0
,,		Hartley Wintney	·73	...	·34	27	6	77·0	16*b*	35·0	4	0	8
III.		Hitchin	·36	— 2·14	·12	30	7	77·0	16	39 0	11	0	...
,,		Winslow (Addington)	·49	— 2·18	·18	26	5	75·0	16	35·0	6	0	0
IV.		Bury St. Edmunds (Westley)	·66	— 2·04	·22	27	5	72·0	16	45·0	25	0	...
,,		Norwich (Brundall)	·89	...	·18	27	11	80·0	16	41·2	25	0	0
V.		Winterbourne Steepleton ...	1·74	...	·59	30	8	71·0	8	35·0	4	0	4
,,		Torquay (Cary Green)	1·05	...	·32	26	8	72·9	8	45·7	7	0	0
,,		Polapit Tamar [Launceston]..	1·87	— 1·84	·58	1	16	74·8	7	31·7	6	1	2
VI.		Stroud (Upfield)	·40	— 2·51	·15	30	6	72·0	8	42·0	30	0	...
,,		Church Stretton (Woolstaston)	·72	— 1·78	·22	30	11	78·0	16	41·0	3	0	0
,,		Worcester (Diglis Lock)	·98	— 1·46	·26	22	6	...	...	...	...	...	...
VII.		Boston	·40	— 2·37	·30	30	4	75·0	6, 12	40·0	20*e*	0	...
,,		Hesley Hall [Tickhill].....	1·27	— ·89	·99	16	6	70·0	22	38·0	21*f*	0	0
,,		Breadsall Priory	·84	...	·44	30	5	...	..	...	...	...	...
VIII.		Manchester (Plymouth Grove)	1·23	— 2·24	·30	26	12	79·0	16	40·0	19	0	0
IX.		Wetherby (Ribston Hall) ...	·79	— 1·67	·31	7	6	...	...	...	...	...	...
,,		Skipton (Arncliffe)	2·41	— 2·35	·65	26	16	...	...	...	...	...	...
,,		Hull (Pearson Park).	1·37	— 1·07	·77	16	7	73·0	13	37·0	14	0	0
X.		Newcastle (Town Moor)	·90	— 1·88	·35	7	11	...	...	..	...	...	...
,,		Borrowdale (Seathwaite).....	10·19	— 1·54	2·95	26	16	77·3	15	36·3	3	0	...
XI.	WALES.	Cardiff (Ely).....	1·44	— 2·30	·45	26	10	...	...	...	...	...	...
,,		Haverfordwest	2·72	— 1·68	1·29	29	13	73·2	16	37·7	20	0	1
,,		Aberystwith (Gogerddan) ...	3·78	— ·49	·65	21	15	78·0	13	...	...	...	...
,,		Llandudno.....	1·05	— 1·17	·21	27	13	72·5	16	43·5	3	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·33	— ·23	1·12	26	16	71·0	15*c*	37·0	3	0	0
XIII.		Edinburgh (Blacket Place)...	1·86	...	·58	26	17	70·2	14	38·0	3	0	0
XIV.		Colmonell	3·71	...	·91	26	16	80·0	13	35·0	2	0	...
XV.		Tighnabruaich	5·62	...	1·24	26	16	62·0	9, 17	39·0	2	0	...
,,		Mull (Quinish).....	5·97	+ ·94	1·06	26	20	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·40	— ·61	1·10	27	9	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·30	— ·21	·85	26	14	74·4	14	34·4	3	0	...
XVII.		Braemar	2·49	— ·37	·46	23*a*	15	72·0	15	30·4	3	1	8
,,		Aberdeen (Cranford)	2·20	...	·53	26	21	70·0	14	30·0	24	...	...
,,		Cawdor (Budgate)	2·78	+ ·03	·53	26	18	...	...	...	...	...	...
XVIII		Strathconan [Beauly]	4·15	+ ·47	·65	27	14	..	...	...	...	...	...
,,		Glencarron Lodge.....	8·70	...	1·70	26	22	73·2	15	35·1	3	0	...
XIX.		Dunrobin	2·34	— ·25	·55	26	13	66·0	20	36·0	26	0	...
,,		S. Ronaldshay (Roeberry) ...	3·32	+ ·66	·66	25	21	66·0	14	39·0	25	0	...
XX.	IRELAND.	Darrynane Abbey.....	1·51	...	·53	29	16	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	1·14	— 1·78	·46	29	6	70·0	7, 16	35·0	4	0	...
,,		Broadford (Hurdlestown) ...	...	...	...	...	...	...	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	1·32	— 1·50	·43	17	8	...	...	...	...	...	...
,,		Dublin (Fitz William Square)	·91	— 1·06	·26	17	10	68·9	23	41·2	12	0	0
XXII.		Ballinasloe	2·07	— ·72	·61	26	15	67·0	13*g*	41·0	3	0	...
,,		Clifden (Kylemore)	4·01	...	1·00	28	14	...	...	...	...	...	...
XXIII		Waringstown	2·19	— ·97	·39	1	11	74·0	...	35·0	...	0	...
,,		Londonderry (Creggan Res.).	3·34	— ·44	·78	29	20	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·84	— ·54	·92	29	16	72·0	13	33·0	2	0	1

+ Shows that the fall was above the average ; — that it was below it.

a—and 29. *b*—and 17, 18. *c*—and 16. *d*—and 21, 26. *e*—and 25. *f*—and 22. *g*—and 14.

METEOROLOGICAL NOTES ON SEPTEMBER, 1900.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

TENTERDEN.—Another month of drought and heat; ponds and ditches being empty or very low. Graziers call it the worst year for scarcity of grass since 1893. The mean temp. was higher than in 1899, but considerably lower than in 1895 and 1898. Duration of sunshine 204 hours. Absolute drought for 15 days ended on 16th, and partial drought for 30 days, with ·24 in. of R ended on 26th.

HARTLEY WINTNEY.—A dry month, with much sunshine. R fell on 6 days only, being 1·74 in. below the average. The driest September since 1890. Ozone on eight days, with a mean of 2·6.

WINSLOW, ADDINGTON.—A very fine month, with not a drop of R until the 24th. Only once in 30 years has less R fallen in September, but in 1898 only ·41 in. fell on 4 days.

BURY ST. EDMUNDS, WESTLEY.—A fine, dry month. Since 1856 there have been only 4 drier Septembers.

NORWICH, BRUNDALL.—A very fine, warm and dry month. Distant L on 16th.

WINTERBOURNE STEEPLETON.—The principal feature of the month was the drought of 20 days duration, during which bright sunshine prevailed daily, with only about three exceptions.

TORQUAY, CARY GREEN.—R 1·31 in. below, and mean temp. 0°·7 above, the average. Duration of sunshine 22 hours 15 mins. above the average. No sunless day. Mean ozone 5·4; greatest daily amount 7·0, with S. to W. winds; least, 0·5, with N.E. wind.

POLAPIT TAMAR [LAUNCESTON].—Very dry on the whole for the first three weeks. The comparatively calm weather that prevailed throughout was particularly noticeable. Heavy T and vivid L between 4.30 and 5 a.m. on 16th.

BREADSALL PRIORY.—An exceptionally dry month.

MANCHESTER, PLYMOUTH GROVE.—Upon the whole very fine weather prevailed.

WALES.

HAVERFORDWEST.—A fine, bright month generally. Temp. high, with abundance of bright sunshine. Wet weather set in after the 20th, with a good deal of fog, and the last five days were stormy. Corn crops were harvested in good condition, and the quality of the grain is fairly good. Potatoes were not nearly so good as usual, and fruit crops, though abundant, did not ripen well. Duration of bright sunshine, 122·4 hours. Slight TS on 16th.

ABERYSTWITH, GOGERDDAN.—A very fine month, but showery during the last fortnight.

SCOTLAND.

CARGEN [DUMFRIES].—A wet, unsettled month; very unfavourable for harvest operations in the later districts.

EDINBURGH, BLACKET PLACE.—Mean temp. 1°·5 above, and R 36 per cent. below, the average. Dense fog on the mornings of 16th and 17th.

COLMONELL, CLACHANTON.—R ·40 in. below, and mean temp. 57° 8, or 4°·1 above, the average of 24 years. Gales on four occasions.

TIGHNABRUAICH.—In the first part of the month the weather was good; calm and foggy in the mornings. During the second half there were strong winds and too much R.

ABERDEEN, CRANFORD.—Very little sunshine during the month.

S. RONALDSHAY, ROEBERRY.—The weather was very good until the 21st, but the latter part was very unsettled. Mean temp. 51°·9, or 0°·3 above the average of 10 years.

IRELAND.

DARRYNANE ABBEY.—A dry month, especially in the first half, which was fine and warm. Only ·10 in. of R fell from the 1st to the 16th.

WATERFORD, BROOK LODGE.—Absolute drought for the first 16 days of the month. Thick fog on several mornings. Mean temp. 56°·2.

DUBLIN, FITZWILLIAM SQUARE.—A very fine and enjoyable month. Absolute drought prevailed until the 17th, but from the 20th onward less settled weather was experienced and R fell frequently. Mean temp. 57°·6, or 1°·8 above the average. High winds were noted on 8 days, but attained the force of a gale on only one occasion, the 26th. Fog on 7 days. Solar halo on 18th.

OMAGH, EDENFEL.—There was hardly any interruption to the magnificent harvest weather that commenced on August 25th, and only terminated on September 22nd, but there has seldom been so great irregularity in the ripening of cereals, for while on some soils an abundant harvest was gathered well within the fine period mentioned, on a large area of this county the sodden shocks still filled the fields on October 6th, for the weather that broke on September 23rd still showed no signs of changing from the saturating rains that have since prevailed.